5. Total Maximum Daily Load(s)

A TMDL prescribes an upper limit on discharge of a pollutant from all sources so as to assure water quality standards are met. It further allocates this load capacity (LC) among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a wasteload allocation (WLA); and nonpoint sources, each of which receives a load allocation (LA). Natural background (NB), when present, is considered part of the LA, but is often broken out on its own because it represents a part of the load not subject to control. Because of uncertainties regarding quantification of loads and the relation of specific loads to attainment of water quality standards, the rules regarding TMDLs (Water quality planning and management, 40 CFR Part 130) require a margin of safety (MOS) be a part of the TMDL.

Practically, the margin of safety is a reduction in the load capacity that is available for allocation to pollutant sources. The natural background load is also effectively a reduction in the load capacity available for allocation to human-made pollutant sources. This can be summarized symbolically as the equation: LC = MOS + NB + LA + WLA = TMDL. The equation is written in this order because it represents the logical order in which a loading analysis is conducted. First the load capacity is determined. Then the load capacity is broken down into its components: the necessary margin of safety is determined and subtracted; then natural background, if relevant, is quantified and subtracted; and then the remainder is allocated among pollutant sources. When the breakdown and allocation are completed the result is a TMDL, which must equal the load capacity.

Another step in a loading analysis is the quantification of current pollutant loads by source. This allows the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary in order for pollutant trading to occur. The load capacity must be based on critical conditions – the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both load capacity and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can be more complicated than it may appear on the surface.

A load is fundamentally a quantity of a pollutant discharged over some period of time, and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for “other appropriate measures” to be used when necessary. These “other measures” must still be quantifiable, and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads and allow “gross allotment” as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

5.1 In-stream Water Quality Targets

In-stream water quality targets were selected such that they will restore full support of designated beneficial uses. The following provides a discussion of target selection and monitoring locations.

Target Selection

Important considerations in target selections were critical periods for target application, recovery time for the water body, and appropriateness of surrogates.

Section 2.4 of the subbasin assessment outlines the water quality targets / standards for each water body of concern (tributaries, Snake River, C.J. Strike Reservoir). Accompanying each target is the justification for the target and a description of the linkage between meeting the target(s) and improving beneficial use support status. These targets and standards also serve as the targets for TMDL development.

Table 41 summarizes the targets on which each respective TMDL is based. The values shown represent the condition(s) the water should be in when the TMDL(s) are met.

It should also be noted that flow alteration is listed as a "pollutant of concern" in Little Canyon Creek. However, EPA does not believe that flow (or lack of flow) is a pollutant as defined by CWA Section 502(6). Since TMDLs are not required to be established for water bodies impaired by pollution but not pollutants, a TMDL has not been established for the flow alteration aspect of Little Canyon Creek.

Table 41. Water quality targets used in TMDL development.

Pollutant	TMDL Target	Water Bodies for Which TMDLs are Developed Using the Target
Sediment	A geometric mean of 50 mg/L suspended sediment for no longer than 60 consecutive days	Snake River Little Canyon Creek Cold Springs Creek
Sediment	Less than or equal to 30% fine material (particles less than 6.0 mm in diameter) in riffles	Little Canyon Creek Cold Springs Creek
Nutrients (Total Phosphorus)	Less than or equal to 0.075 mg/L (75 µg/L) total phosphorus at all locations	Snake River C.J Strike Reservoir

Monitoring Locations

Monitoring locations for each water body are discussed in detail in Section 2.4. Refer to that section for the location of monitoring points for each water body. An attempt was made collect or use data from monitoring stations that were representative of the segments of interest.

5.2 Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading," (Water quality planning and management, 40 CFR § 130.2(I)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of sources (land use) and area (such as a subwatershed), but may be aggregated by type of source or land area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads.

The type and amount of data available greatly influence how DEQ calculates existing loads. These methods have been discussed in detail in the Data Assessment Methods section of this document (see Section 2.4); a summary of the methods used to determine loads for the four segments targeted for TMDLs (see Table 36) is as follows:

Nutrient Load—C.J. Strike Reservoir

The current nutrient load in C.J. Strike Reservoir is based on the sum of the boundary conditions to the reservoir, which includes the Snake River and Bruneau River arms. An attempt was not made to base the current reservoir load on in-reservoir concentrations and the reservoir flow rate (through the reservoir).

Nutrient and Sediment Load—Snake River at King Hill

The current nutrient and sediment loads in the Snake River at King Hill were calculated using a flow of 11,407 cfs. It was determined that this flow represents typical flow conditions in the river. The loading concentrations are based on measured water column data from 1997-2002. These years include high, medium and low flow years, thereby representing the variation that is expected to occur over the long term.

Sediment Load—Cold Spring and Little Canyon Creeks

In Cold Springs and Little Canyon Creeks, where the primary source of sediment is from bank erosion, existing sediment loads were determined using the bank erosion inventory process, which provided direct measurement of erosion rates within the reach. The erosion rate was then used to calculate the current in-stream delivery of sediment within the system. In instances where sediment was generated via agricultural or other nonpoint source activities, the existing loads were calculated using

5.3 Sediment Total Maximum Daily Loads

This section describes the required elements of the sediment TMDLs for the Snake River, Cold Springs Creek and Little Canyon Creek, including load capacity, margin of safety, seasonal variation, background, reserve for growth, and sediment load and wasteload allocations.

Load Capacity

The load capacity (LC) is the amount of pollutant a water body can receive without violating water quality standards. Seasonal variations and a margin of safety (MOS), to account for any uncertainty, are calculated within the load capacity. The MOS accounts for uncertainty about assimilative capacity, the precise relationship between the selected target and beneficial use(s), and variability in target measurement. The load capacity is based on existing uses within in the watershed. The load capacity for each water body and specific pollutant are tailored to both the nature of the pollutant and the specific use impairment.

A required part of the loading analysis is that the load capacity be based on critical conditions – the conditions when water quality standards are most likely to be violated. If it is protective under critical conditions, a TMDL will be *more* protective (or, at worst, *as* protective) under other conditions. Because both load capacity and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can be more complicated than it may appear on the surface.

Sediment load capacities for the Snake River, Cold Springs Creek, and Little Canyon Creek are as follows.

Snake River

The LC for the Snake River sediment TMDL is determined by using the target of 50 mg/L suspended sediment concentration (SSC) and an average flow value of 11,407 cfs (calculated from 1997-2002 flow data). The 50 mg/L SSC chronic target was used for developing the TMDL because, as opposed to the 80 mg/L acute target, it represents conditions that are more likely to be achieved over the long term with BMP implementation.

As noted above, the sediment load capacity is based on an average flow that is expected to represent typical flow conditions. While the load capacity is helpful in gaining a relative understanding of the reduction required, and will apply reasonably over most water years, it should be noted that the exact level of reduction required will depend on flow and concentration values specific to a given water year.

Cold Springs and Little Canyon Creeks

In Cold Springs Creek and Little Canyon Creeks, where sediment primarily results from stream bank erosion, the load capacity is based on the load generated from banks that are greater than 80% stable. This load defines the load capacity for the remaining segments of the stream.

Margin of Safety

The margin of safety (MOS) factored into the Snake River sediment TMDL is 5.0% of the load capacity. That is, 5.0% of the load in the river when the 50 mg/L target is met is removed from being available. This 5.0% MOS accounts for uncertainty in the data used to develop the loads and adds a level of conservativeness to the TMDL.

The MOS for the Cold Springs Creek and Little Canyon Creek TMDLs are implicit due to several conservative factors used to determine the existing sediment loads. These factors include the following:

- The desired bank erosion rates are representative of background conditions.
- The water quality target for percent fines is consistent with values measured and as set by local land management agencies, based on established literature values, and incorporate an adequate level of fry survival to provide for stable salmonid production.

Seasonal Variation

TMDLs must be established with consideration of seasonal variation. In the Snake River and its tributaries, there are seasonal influences on nearly every pollutant addressed. The summer growing season is typically when concentrations of sediment and nutrients are the highest. Seasonal variation as it relates to development of these TMDLs is addressed simply by ensuring that the loads are reduced during the *critical period* (when beneficial uses are impaired and loads are controllable). Thus, the effects of seasonal variation are built into the load allocations.

The critical period for each sediment TMDL is based on the time of year when beneficial uses must be protected and when pollutant loads exceed the assimilative capacity. Each respective TMDL was developed such that the water quality standards will be achieved year-round. Table 42 shows the critical period for each sediment TMDL.

Table 42. Critical periods for sediment TMDLs.

Water Body	Pollutant	Critical Period (Time of Year the TMDL is Applicable)
Snake River	Sediment	January-December
Little Canyon Creek	Sediment	January-December
Cold Springs Creek	Sediment	January-December

Background

The sediment allocations for the Snake River, Cold Springs Creek, and Little Canyon Creeks are not explicitly adjusted to account for background conditions. Since the Snake River at King Hill and Indian Cove is already below the 50 mg/L SSC target (18 and 25 mg/L, respectively) no additional reductions will be required by the TMDL (see allocations below). As a result, it is not necessary to include the any potential background load in the allocations.

Additionally, the Cold Springs Creek and Little Canyon Creek TMDLs already include an accommodation for background sediment by way of the 80% bank stability target. That is, the 80% bank stability target allows for 20% of the banks to be less than stable, which is to be expected in a stream's naturally functioning state. Thus, background is considered, but no adjustments are made to the allocations.

Reserve for Growth

The sediment allocation for the Snake River includes a 10% reserve for growth. That is, 10% of the load in the river when the 50 mg/L target is met is removed and is made available for any future sources of sediment, which are typically point sources. While an abundance of growth is not expected in the near future, the 10% reserve helps accommodate any growth that may occur while still ensuring that the river will meet the TMDL.

The Cold Springs Creek and Little Canyon Creek TMDLs do not include a reserve for growth. While growth may occur, the expectation is that no additional bank sediment will be discharged to the systems as a result of the growth. This can be achieved via the use of best management practices.

Sediment Load and Wasteload Allocations

This section describes the sediment load and wasteload allocations for the Snake River and Cold Springs Creek and Little Canyon Creek TMDLs.

Snake River Sediment Allocations

The SSC water column target in the Snake River between King Hill and Indian Cove, on which the TMDL is based, is 50 mg/L. While the target is durational in nature (based on a geometric mean over 60 consecutive days), the TMDL is not based on duration. The 50 mg/L target for the Snake River is intended to provide protection for the mix of aquatic life species that inhabit the river. A detailed discussion of the selection of the targets can be found in the subbasin assessment portion of this document (Chapter 2).

Table 43 shows the sediment load allocation for the Snake River at King Hill and wasteload allocations for the Glenns Ferry WWTP. Table 43 also includes a generalized no-net-increase allocation for the tributaries to the river. DEQ recommends collecting additional data during the implementation phase of the TMDL to further clarify the tributary allocations.

The Glenns Ferry WWTP wasteload allocation is based on the plants current NPDES permit limit for total suspended solids. The relative mass of sediment contributed by the WWTP is quite small. The plant already removes much of the influent suspended solids as part of the treatment process; further treatment at this time would result in high costs with little tangible benefit to the river. However, the plant must continue to meet the minimum percent removal requirement in its permit. Fixed load allocation targets were selected because the management practices that affect sediment loading to the river is not expected to change on a day-to-day basis.

Table 43. Sediment load and wasteload allocations for Snake River at King Hill and the Glenns Ferry WWTP

Name	Typical Existing Load	Load Capacity	Margin of Safety	Reserve for Growth	Allocation Type / Allocation	Percent Reduction from Existing Load
Snake River at King Hill	544 tons/day SSC	1,540 tons/day SSC	77 tons/day SSC	154 tons/day SSC	Load / 1,309 tons/day SSC	0% Typical existing is below LA
Unmonitored[1] Snake River tributaries	Not Defined	N/A	N/A	N/A	No increase beyond current loads	0%
Glenns Ferry WWTP[2]					Wasteload /	
• Average Monthly	125 lb/day TSS	N/A	N/A	N/A	125 lb/day TSS	0%
• Average Weekly	188 lb/day TSS	N/A	N/A	N/A	188 lb/day TSS	0%

[1] SSC loading data are not available for the tributaries to the Snake River. DEQ recommends initiating a monitoring regime as part of the TMDL implementation plan.
[2]Based on current NPDES permit limits for TSS

Little Canyon Creek and Cold Springs Creek are receiving sediment allocations due to excess stream bank erosion. Table 44 shows the load allocations for the representative segment. The monitored reaches, as well as the segments the reaches represent, are shown geospatially in Figure 76. The worksheets used to derive these load allocations are located in Appendix M.

The derivation of the numbers shown in Table 44 was based on the following:

- The current erosion rate is based on the bank geometry and lateral recession rate (as described in Appendix E) at each measured reach.
- The target erosion rate is based on the bank geometry of the measured reach and the lateral recession rate at a calculated reference reach.
- The reference reach is based on the hydrogeologic conditions for that stream that would result in greater than 80% bank stability and less than 30% fine substrate material in riffles.
- The loading capacity is the total load present when banks are at least 80% stable. As such, the loading capacity and the load allocations are the same. Note that these are the overall decreases necessary in the stream, but can only reasonable apply to areas where banks are less than 80% stable.

Table 44. Stream bank erosion load allocations for Little Canyon Creek and Cold Springs Creek.

Water Body	Current Erosion Rate (tons/mile/ year)	Target Erosion Rate (tons/mile/ year)	Current Total Erosion (tons/year)	Target Total Erosion (tons/year) Load Allocations Loading Capacity	% Decrease
Little Canyon Creek, Segment 1	315.97	236.98	183.26	137.45	25
Little Canyon Creek, Segment 2	345.58	218.26	1,814.31	1,145.88	36.84
Cold Springs Creek	113.36	82.44	457.97	333.07	29.41

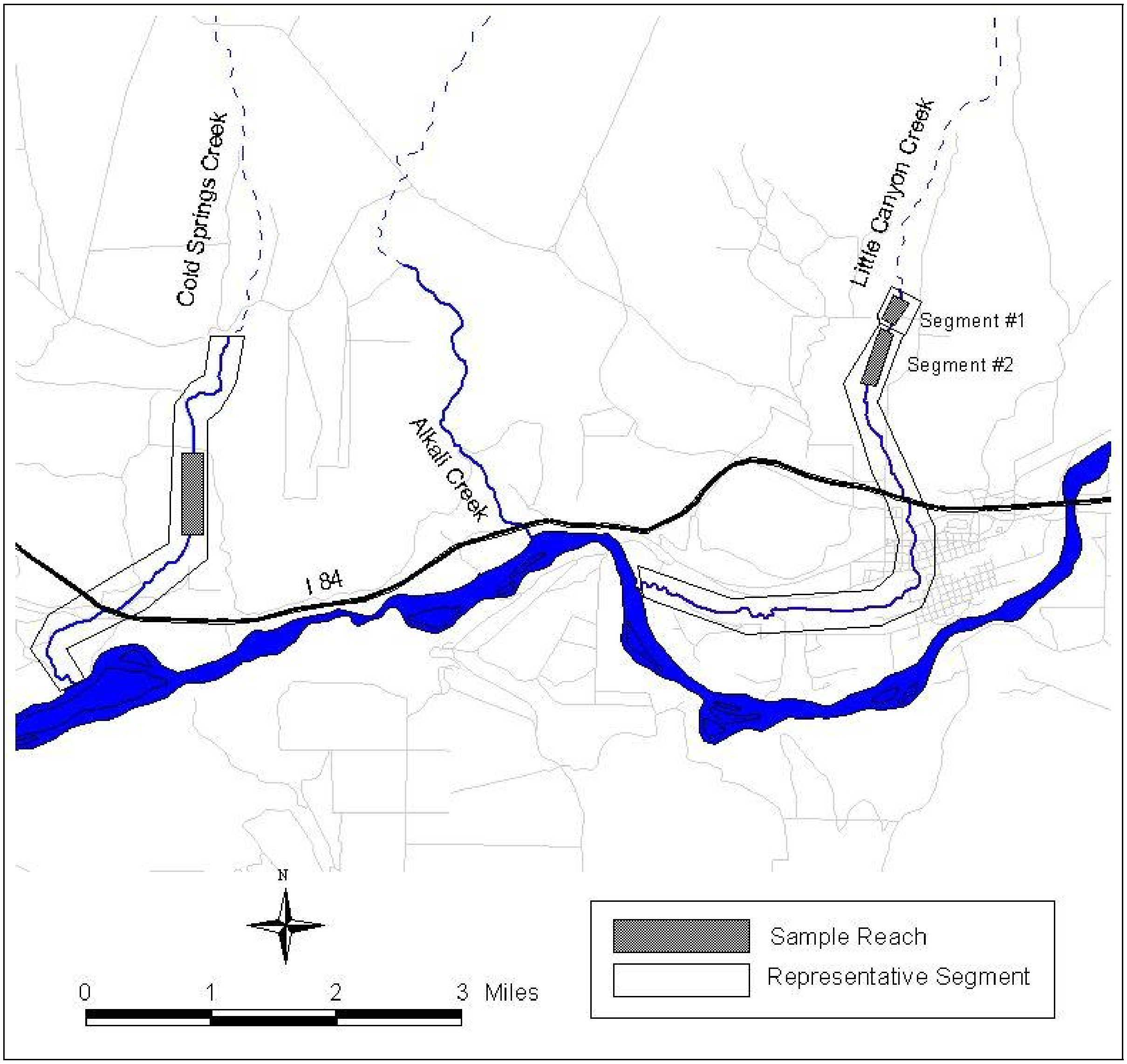


Figure 76. Segments of Little Canyon Creek and Cold Springs Creek receiving sediment load allocations.

5.4 Nutrient Total Maximum Daily Loads

This section describes the required elements for the Snake River and C.J. Strike Reservoir nutrient TMDLs, including load capacity, margin of safety, seasonal variation, background, reserve for growth, and nutrient load and wasteload allocations.

Load Capacity

The load capacity (LC) is the amount of pollutant a water body can receive without violating water quality standards. Seasonal variations and a margin of safety (MOS) to account for any uncertainty are calculated within the load capacity. The MOS accounts for uncertainty about assimilative capacity, the precise relationship between the selected target and beneficial use(s), and variability in target measurement. The load capacity is based on existing uses within in the watershed. The load capacity for each water body and specific pollutant are tailored to both the nature of the pollutant and the specific use impairment.

A required part of the loading analysis is that the load capacity be based on critical conditions – the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will more likely be *as* protective under other conditions. Because both load capacity and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can be more complicated than it may appear on the surface.

Snake River

The load capacity for the Snake River nutrient TMDL is determined by using the target of 0.075 mg/L TP and an average flow value of 11,407 cfs (calculated from 1997-2002 flow data). As noted above, the phosphorus load capacity is based on an average flow that is expected to represent typical flow conditions. While the load capacity is helpful in gaining a relative understanding of the reduction required, and will apply reasonably over most water years, it should be noted that the exact level of reduction required will depend on flow and concentration values specific to a given water year.

Currently, total phosphorus levels are at or above the target concentration year-round. While the aquatic plant growth and algae blooms that occur as a result of the excess nutrients are seasonal in nature, typically extending from the beginning of May through the end of September, the effects of the annual nutrient loading on the reservoir must be recognized. As a result, the TP load reduction requirements will be applied annually.

Due to water column nutrients, particularly TP, being more abundant than plant uptake rates, responses by plant communities to management efforts will take time. As TP inputs are reduced, plants that obtain nutrients from the water column (such as algae and epiphytes) will likely be the first to decline. Because nutrients persist longer in sediments, plants that obtain nutrients from the sediments (such as macrophytes) will persist longer. Nevertheless, as reductions in TP (and sediment) continue, sediment bound nutrients will gradually be depleted as plant uptake outpaces recharge rates.

C.J. Strike Reservoir

The load capacity for the Snake River nutrient TMDL is determined by using the target of 0.075 mg/L TP and average flow values for the Snake River and the Bruneau River—11,375 cfs and 325 cfs, respectively—both of which are calculated from 1997-2002 flow data.

The phosphorus load capacity is identified for this average flow scenario. While this value is helpful in gaining a relative understanding of the reduction required, and will apply reasonably over most water years, it should be noted that the exact level of reduction required will depend on flow and concentration values specific to a given water year.

It should also again be noted that an attempt was not made to determine a load capacity for the reservoir itself. The load capacity and the ensuing TMDL for C.J. Strike Reservoir are based on inflowing loads from the Snake River and the Bruneau River.

Margin of Safety

The margin of safety (MOS) factored into the Snake River nutrient TMDL is 5.0% of the load capacity. That is, 5.0% of the load in the river when the 0.075 mg/L TP target is met is removed from being available. This 5.0% MOS accounts for uncertainty in the data used to develop the loads and adds a level of conservativeness to the TMDL.

No explicit MOS is factored into the C.J. Strike Reservoir nutrient TMDL. Rather, the MOS is implicit, based on the MOS established as part of the river nutrient TMDL. The reservoir boundary condition for model simulation purposes is based on the premise that the river will meet its TMDL (0.075 mg/L TP). Since the river TMDL includes a 5% MOS, the reservoir TMDL includes an implicit MOS.

Seasonal Variation

TMDLs must be established with consideration of seasonal variation. In the Snake River and C.J. Strike Reservoir, there are seasonal influences on nearly every pollutant addressed. The summer growing season is typically when nutrient concentrations of sediment are the highest. Seasonal variation, as it relates to development of the TMDL, is addressed simply by ensuring that the loads are reduced during the critical period (when beneficial uses are impaired and loads are controllable). Thus, the effects of seasonal variation are built into the load allocations.

Nutrient TMDL Critical Periods

The critical periods for the Snake River and C.J. Strike Reservoir TMDLs are based on the time of year when beneficial uses must be protected and when pollutant loads exceed the assimilative capacity. Each respective TMDL was developed such that the water quality standards will be achieved year-round. Table 45 shows the critical period for each TMDL.

Table 45. Critical periods for Snake River and C.J. Strike Reservoir TMDLs.

Water Body	Pollutant	Critical Period (Time of Year the TMDL is Applicable)
Snake River	Nutrients, Sediment	January-December
C.J. Strike Reservoir	Sediment	January-December

Reserve for Growth

The nutrient and sediment allocations for the Snake River include 5% and 10%, respectively, reserves for growth. That is, 5% of the overall nutrient load and 10% of the overall sediment load in the river when the targets are met is removed and made available for any future sources, which are typically point sources. While an abundance of growth is not expected in the near future, these reserves help accommodate any growth that may occur while still ensuring that the river will meet the TMDLs.

Nutrient Load and Wasteload Allocations

This section describes the nutrient load and wasteload allocations for the Snake River and C.J. Strike Reservoir TMDLs.

Snake River Nutrient Allocations

The total phosphorus water column target in the Snake River between King Hill and Indian Cove, on which the TMDL is based, is less than or equal to 0.075 mg/L (75 µg/L). The target is intended to apply at any location in the river between King Hill and Indian Cove. The target is intended to provide protection for the mix of aquatic life species that inhabit the river as well as reduce the amount of aquatic plant growth. A detailed discussion of the selection of the target can be found in the subbasin assessment portion of this document (Chapter 2).

Table 46 shows the total phosphorus load allocation for the Snake River at King Hill and the wasteload allocation for the Glenns Ferry WWTP. Table 46 also includes a generalized no-net-increase allocation for the tributaries to the river. There are no specific load allocations because the data are very limited and not robust enough to develop accurate allocations. DEQ recommends collecting additional data during the implementation phase of the TMDL to further clarify the tributary allocations.

The flow component for the Glenns Ferry WWTP wasteload allocation is based on the plant's current design capacity. The current NPDES permit does not have a total phosphorus effluent limit; as such, the current effluent concentration is not known. DEQ estimated, in conjunction with the City of Glenns Ferry, an effluent concentration of 7.0 mg/L. This concentration is likely higher that the actual concentration. The Water Environment Federation Manual of Municipal Wastewater Practice (1992) reported 7.0 mg/L as the typical total phosphorus concentration for *untreated* domestic effluent. Tchobanoglous (1991) reported values as low as 4 mg/L for untreated domestic effluent, with the low values applying to small communities, such as Glenns Ferry. Given that most lagoon facilities remove between 15% and 50% (EPA 2004) of total phosphorus, the actual total phosphorus effluent concentration is likely far less than 7.0 mg/L. To account for this unknown, DEQ recommends revising the Glenns Ferry WWTP wasteload allocation once the TP effluent concentration has been better characterized based on monitoring data. The WWTP is required to begin monitoring its effluent in January 2006, but DEQ suggests that characterization monitoring begin sooner.

Table 46. Nutrient load and wasteload allocations for Snake River at King Hill and the Glenns Ferry WWTP.

Name	Typical Existing Load	Load Capacity	Margin of Safety	Reserve for Growth	Allocation Type / Allocation	Percent Reduction from Existing Load
Snake River at King Hill	2,349 kg/day TP	2,097 kg/day TP	105 kg/day TP	105 kg/day TP	Load / 1,888 kg/day TP	19.6%
Snake River tributaries[1]	Not Defined	N/A	N/A	N/A	No increase beyond current loads	0%
Glenns Ferry WWTP[2]	11.6 kg/day TP	N/A	N/A	N/A	Wasteload / 11.6 kg/day TP	0%

[1] Conclusive TP loading data are not available for the tributaries to the Snake River. DEQ recommends initiating a monitoring regime as part of the TMDL implementation plan.
[2]Based on the design capacity for flow and an estimated TP concentration. DEQ recommends revising the Glenns Ferry WWTP wasteload allocation once the TP effluent concentration has been better characterized based on monitoring data.

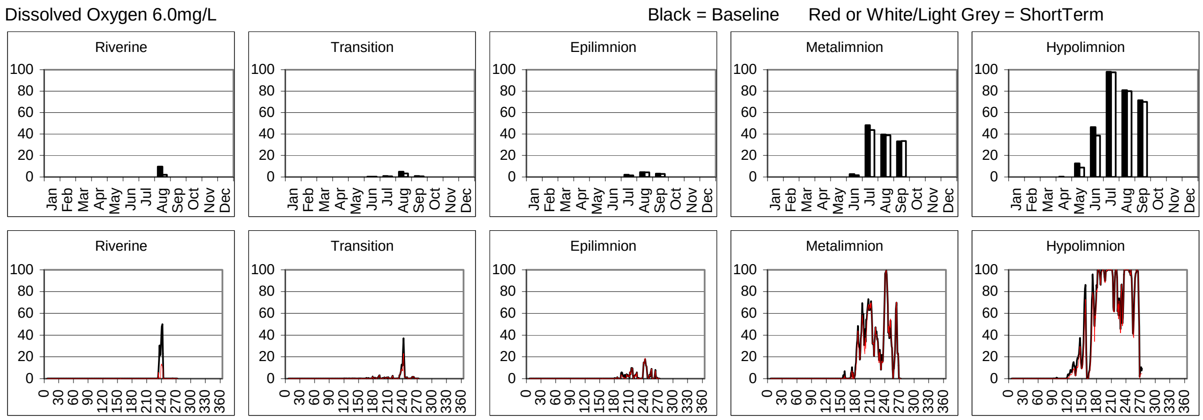
C.J. Strike Reservoir Nutrient Allocations

The CE-QUAL-W2 water quality model was used to simulate the water quality response to the 0.075 mg/L total phosphorus target in the C.J. Strike Reservoir. The model was also used to simulate the water quality response to a target of 0.050 mg/L TP in the reservoir. Since there was very little detectable change in reservoir DO by dropping the target to 0.050 mg/L, the analysis went forward with 0.075 mg/L as the target. This keeps the King Hill-C.J. Strike Reservoir target consistent with the upstream target (Mid Snake River TMDL).

Idaho Power Company and contract personnel performed the modeling work, with review from DEQ. Two primary model simulations were performed: a projection of short-term (benefits realized quickly) and long-term (benefits realized over an extended period) water quality improvements, both based on the attainment of the 0.075 mg/L total phosphorus target. The following section contains a summary of the information provided by Idaho Power Company regarding this modeling effort. The full memorandum, which contains more detail, is located in Appendix N.

To simulate meeting the 0.075 mg/L TP water column target, dissolved and organic phosphorus were reduced at the reservoir boundary (Indian Cove) such that the target was not exceeded. Additionally, the boundary condition was adjusted so that the dissolved oxygen concentration would not fall below 6.0 mg/L. These are the river conditions expected to be achieved upon implementation of the Snake River nutrient TMDL, so they also serve as appropriate reservoir boundary conditions for modeling purposes.

The results of the short-term simulation, which assumes a boundary condition water column concentration of 0.075 mg/L and all DO values greater than 6.0 mg/L, are shown in Figure 77. The dark colored lines show the percent of DO values below the 6.0 mg/L criterion at baseline (current) conditions—these are the violations described in the C.J. Strike Reservoir assessment in section 2.4. The light colored lines show the percent of DO values below the 6.0 mg/L criterion after implementing the .075 mg/L TP target, but with no resulting change in sediment oxygen demand.

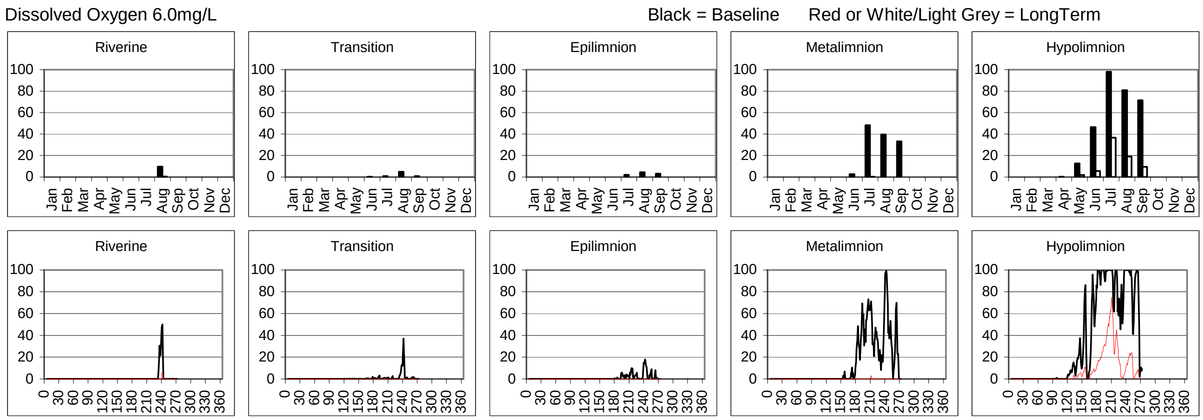


Y-Axis is percent of zone/strata volume below 6 mg/L, X-Axis is Julian day.

Figure 77. Percent of volume below 6.0 mg/L after short-term improvement resulting from implementation of the 0.075 mg/L TP target for the Upstream Snake River

The initial response of the reservoir to full implementation of the 0.075 mg/L TP target results in a very slight decrease in DO violations in the metalimnion. When the Snake River TMDL is first implemented, sediment oxygen demand will not change immediately. The response is slow, and this slow response time limits the initial level of improvement in the lacustrine zone (metalimnion) of the reservoir. (As mentioned above, similar results were seen with a target of 0.050 mg/L TP.)

Similarly to the short-term simulation shown in Figure 77, the reservoir response to the long-term simulation was modeled by again assuming a boundary condition water column concentration of 0.075 mg/L and all DO values greater than 6.0 mg/L (Figure 78). However, an additional assumption that the sediment oxygen demand (SOD) in the reservoir had reached a long-term baseline of 0.1 g m^{-2} day^{-1} was made. This SOD is more typical of naturally occurring sediment oxygen demand levels (Cole and Wells 2000). Additional explanation for this selecting this SOD is located in Appendix N. Again, the dark colored lines show the percent of DO values below the 6.0 mg/L criterion at baseline (current) conditions. The light colored lines show the percent of DO values below the 6.0 mg/L criterion after implementing the .075 mg/L TP target and with the reservoir reaching a baseline SOD of 0.1 g m^{-2} day^{-1}.

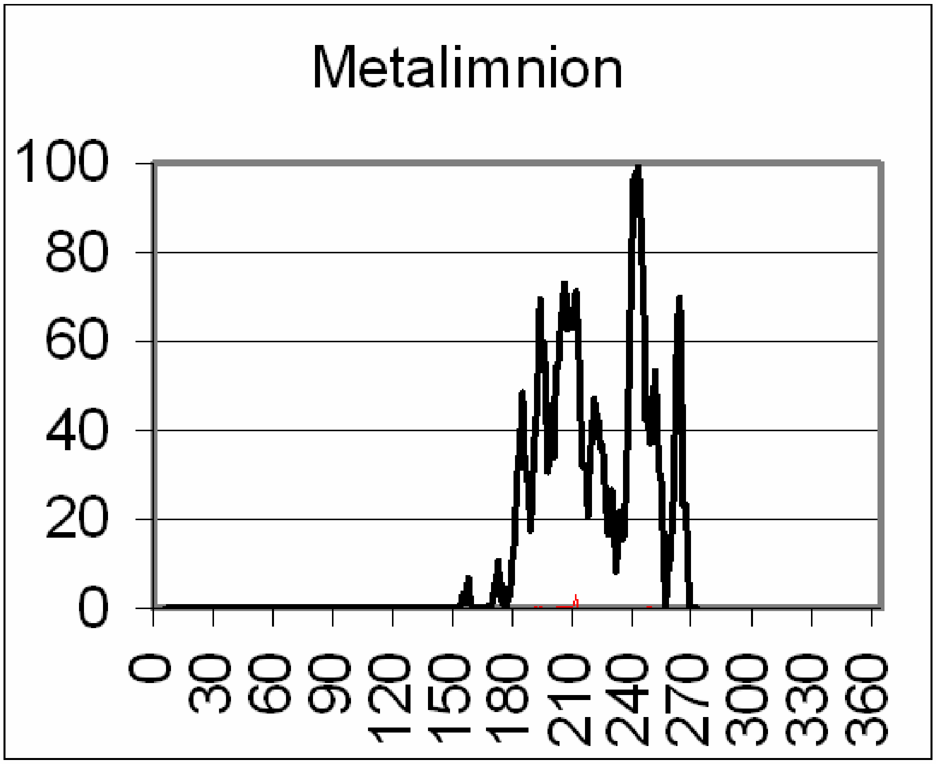


Y-Axis is percent of zone/strata volume below 6 mg/L, X-Axis is Julian day. ***Metalimnion has a small spike about Julian day 220.***

Figure 78. Percent of volume below 6 mg/L after long-term improvements resulting from implementation of the 0.075 mg/L TP target for the Upstream Snake River and resulting decrease in SOD to 0.1 g m^{-2} day^{-1}.

After meeting the 0.075 mg/L TP target and achieving a long-term baseline SOD of 0.1 g m^{-2} day^{-1}in the reservoir, there are substantial improvements in metalimnetic dissolved oxygen concentrations.

Only on Julian day 210 (July) do any values below 6.0 mg/L remain in the metalimnion. This is illustrated in Figure 79. Again, the dark line represents baseline (current) conditions while the light line represents long-term improved conditions.



Y-Axis is percent of zone/strata volume below 6 mg/L, X-Axis is Julian day.

Figure 79. Percent of volume below 6 mg/L after long-term improvements resulting from implementation of the 0.075 mg/L TP target for the Upstream Snake River and resulting decrease in SOD to 0.1 g m^{-2} day^{-1}

There are a small number of violations in the metalimnion even after long-term baseline conditions are achieved. This mass of dissolved oxygen equates to 2.2 tons/year (Appendix N). An additional dissolved oxygen mass allocation will be necessary to account for this shortfall.

As illustrated above, nutrient concentrations are linked with dissolved oxygen concentrations and closely linked to organic matter concentrations. Elevated concentrations of nutrients can lead to increased growth of algae and associated organic matter when other conditions, such as flow, depth, clarity, and temperature are conducive to enhanced growth. Algae and aquatic plants, in turn, consume oxygen from the water column during periods when respiration is the dominant process and in the aerobic decomposition of the dead algae and other detritus (non-living organic material). Total phosphorus has been identified as the nutrient of concern in the Snake River and C.J. Strike Reservoir. Improvements in dissolved oxygen in the reservoir can be achieved through attainment of growth-limiting concentrations of phosphorus and, ultimately, through long-term reductions in sediment oxygen demand.

The available data show that total phosphorus loading to the C.J. Strike Reservoir originates almost entirely from the Snake River and the Bruneau River, with the Snake River by far accounting for the largest portion. Table 47 contains the load allocations for the Snake River and Bruneau River as they apply to the C.J. Strike Reservoir TMDL.

Table 47. Nutrient load allocations for Snake River at Bruneau River as they apply to the C.J. Strike Reservoir TMDL.

Name	Typical Existing Load[1]	Load Capacity	Load Allocation	Percent Reduction from Existing Load
Snake River at Indian Cove	2315 kg/day TP	2,092 kg/day TP	2,092 kg/day TP	9.6%
Bruneau River	56 kg/day TP	60 kg/day TP	60 kg/day TP	0%

[1] Based on 1997-2002 mean annual flows: Snake River at Indian Cove=11,375 cfs, Bruneau River at Highway 51= 325 cfs

As indicated above, an additional dissolved oxygen load allocation is necessary in C.J Strike Reservoir to offset the calculated reduction in assimilative capacity. **The dissolved oxygen allocation requires the addition of 2.2 tons/year of oxygen into the metalimnion of C.J. Strike Reservoir.** The time when additional oxygen is necessary in the metalimnion of C.J Strike Reservoir is between Julian days 191 and 250 (the first of July through the first of September). However, nearly 80% of the necessity occurs between July 10 and July 31, with the actual level varying from day to day, ranging from 0.01 to 0.80 tons/day. This shows that the actual mass of dissolved oxygen necessary per day is not static and is dependent on system dynamics. The timing of oxygen addition, or other equivalent implementation measures, should be such that it coincides with those periods where dissolved oxygen sags occur and where it will be the most effective in improving aquatic life habitat and support of designated beneficial uses. Water column dissolved oxygen monitoring is also expected to continue.

It should be noted that the direct oxygenation of the metalimnion is not required. The additional 2.2 tons/year can be accomplished through equivalent reductions in total phosphorus or upstream organic matter, or other appropriate mechanisms that can be shown to result in the required improvement of dissolved oxygen in the metalimnion. Direct oxygenation can be used but should not be interpreted as the only mechanism available. Cost effectiveness of both reservoir and upstream BMP implementation should be considered in all implementation projects.

Construction Storm Water

The Clean Water Act requires operators of construction sites to obtain permit coverage to discharge storm water to a water body or to a municipal storm sewer. In Idaho, EPA has issued a general permit for storm water discharges from construction sites. In the past storm water was treated as a non-point source of pollutants. However, because storm water can be managed on site through management practices or when discharged through a discrete conveyance such as a storm sewer, it now requires a National Pollution Discharge Elimination System (NPDES) Permit.

The Construction General Permit (CGP)

If a construction project disturbs more than one acre of land (or is part of larger common development) that will disturb more than one acre), the operator is required to apply for permit coverage from EPA after developing a site-specific Storm Water Pollution Prevention Plan.

Storm Water Pollution Prevention Plan (SWPPP)

To obtain the Construction General Permit, operators must develop a site-specific Storm Water Pollution Prevention Plan. The operator must document the erosion, sediment, and pollution controls they intend to use, inspect the controls periodically and maintain the best management practices (BMPs) through the life of the project

Construction Storm Water Requirements

When a stream is on Idaho's § 303(d) list and has a TMDL developed for it, DEQ incorporates a gross waste load allocation WLA for anticipated construction storm water activities. Where DEQ is unable to quantify a WLA for the TMDL due to complexity and a lack of data, a construction storm water activity that obtains a permit and follows BMPs will be considered in compliance with the TMDL. TMDLs developed in the past that did not have a WLA for construction storm water activities will also be considered in compliance with provisions of the TMDL if they obtain a CGP under the NPDES program and implement the appropriate Best Management Practices.)

Typically there are specific requirements you must follow to be consistent with any local pollutant allocations. Many communities throughout Idaho are currently developing rules for post-construction storm water management. Sediment is usually the main pollutant of concern in storm water from construction sites. The application of specific best management practices from *Idaho's Catalog of Storm Water Best Management Practices for Idaho Cities and Counties* is generally sufficient to meet the standards and requirements of the General Construction Permit, unless local ordinances have more stringent and site specific standards that are applicable.

5.5 Implementation Strategies

The purpose of the implementation strategies are to outline the pathways by which a larger, more comprehensive implementation plan will be developed 18 months after TMDL approval. The comprehensive implementation plan will provide details of the actions needed to achieve load reductions (set forth in a TMDL), a schedule of those actions, and specify monitoring needed to document actions and progress toward meeting state water quality standards. These details are typically set forth in the plans that follows approval of the TMDL. In the meantime, cursory implementation strategies are developed to identify the general issues, such as responsible parties, a time line, and a monitoring strategy for determining progress toward meeting the TMDL goals outlined in this document.

Responsible Parties

Development of the final implementation plan for the King Hill-C.J Strike Reservoir TMDL will proceed under the existing practice established for the state of Idaho. The plan will be cooperatively developed by DEQ, the King Hill-C.J Strike Reservoir WAG, the affected private landowners, and other "designated agencies" with input from the established public process. Of the four entities, the WAG will act as the integrator of the implementation planning process to identify appropriate implementation measures. Other individuals may also be identified to assist in the development of the site-specific implementation plans as their areas of expertise are identified as being beneficial to the process.

Designated state agencies are responsible for assisting with preparation of specific implementation plans, particularly for those sources for which they have regulatory authority or programmatic responsibilities. Idaho's designated state management agencies are as follows:

- Idaho Soil Conservation Commission (ISCC): grazing and agriculture
- Idaho Department of Transportation (ITD): public roads
- Idaho Department of Agriculture (IDA): aquaculture, AFOs, CAFOs
- Idaho Department of Environmental Quality: all other activities

To the maximum extent possible, the implementation plan will be developed with the participation of federal partners and land management agencies (i.e., NRCS, U.S. Forest Service, BLM, U.S. Bureau of Reclamation, etc.). In Idaho, these agencies, and their federal and state partners are charged by the CWA to lend available technical assistance and other appropriate support to local efforts/projects for water quality improvements.

All stakeholders in the King Hill-C.J Strike Reservoir subbasin have a responsibility for implementing the TMDL. DEQ and the "designated agencies" in Idaho have primary responsibility for overseeing implementation, in cooperation with landowners and managers. Their general responsibilities are outlined below.

- **DEQ** will oversee and track overall progress on the specific implementation plan and monitor the watershed response. DEQ will also work with local governments on urban/suburban issues.
- **IDL** will maintain and update approved BMPs for forest practices and mining. IDL is responsible for ensuring use of appropriate BMPs on state and private lands.
- **ISCC**, working in cooperation with local Soil and Water Conservation Districts and ISDA, the ISCC will provide technical assistance to agricultural landowners. These agencies will help landowners design BMP systems appropriate for their property, and identify and seek appropriate cost-share funds. They also will provide periodic project reviews to ensure BMPs are working effectively.
- **ITD** will be responsible for ensuring appropriate BMPs are used for construction and maintenance of public roads.
- **IDA** will be responsible for working with aquaculture to install appropriate pollutant control measures. Under a memorandum of understanding with EPA and DEQ, IDA

also inspects AFOs, CAFOs and dairies to ensure compliance with NPDES requirements.

The designated agencies, WAG, and other appropriate public process participants are expected to:

- Develop BMPs to achieve LAs
- Give reasonable assurance that management measures will meet LAs, through both quantitative and qualitative analysis of management measures
- Adhere to measurable milestones for progress
- Develop a timeline for implementation, with reference to costs and funding
- Develop a monitoring plan to determine if BMPs are being implemented, individual BMPs are effective, LAs and WLAs are being met, and water quality standards are being met

In addition to the designated agencies, the public, through the activities of the WAG and other equivalent processes, will be provided with opportunities to be involved in developing the implementation plan to the maximum extent practical. Public participation will significantly affect public acceptance of the document and the proposed control actions. Stakeholders (landowners, local governing authorities, taxpayers, industries, and land managers) are the most educated regarding the pollutant sources and will be called upon to help identify the most appropriate control actions for each area. Experience has shown that the best and most effective implementation plans are those that are developed with substantial public cooperation and involvement.

Adaptive Management Approach

The goal of the CWA and its associated administrative rules for Idaho is that water quality standards shall be met or that all feasible steps will be taken towards achieving the highest quality water attainable. This is a long-term goal in this watershed, particularly because nonpoint sources are the primary concern. To achieve this goal, implementation must commence as soon as possible.

The TMDL is a numerical loading that sets pollutant levels such that in-stream water quality standards are met and designated beneficial uses are supported. DEQ recognizes that the TMDL is calculated from mathematical models and other analytical techniques designed to simulate and/or predict very complex physical, chemical, and biological processes. Models and some other analytical techniques are simplifications of these complex processes and, while they are useful in interpreting data and in predicting trends in water quality, they are unlikely to produce an exact prediction of how streams and other waterbodies will respond to the application of various management measures. It is for this reason that the TMDL has been established with a MOS.

For the purposes of the King Hill-C.J Strike Reservoir TMDL, a general implementation strategy is being prepared for EPA as part of the TMDL document. Following this submission, in accordance with approved state schedules and protocols, a detailed implementation plan will be prepared for pollutant sources.

For the single point source in the basin (Glenns Ferry WWTP), it is the initial expectation that the WWTP will meet its WLA immediately. This is because the WLA is based on the plant's design capacity and the plant is currently discharging below capacity. For nonpoint sources, DEQ also expects that implementation plans be implemented as soon as practicable. However, DEQ recognizes that it may take some time, from several years to several decades, to fully implement the appropriate management practices. DEQ also recognizes that it may take additional time after implementation has been accomplished before the management practices identified in the implementation plans become fully effective in reducing and controlling pollution. In addition, DEQ recognizes that technology for controlling nonpoint source pollution is, in many cases, in the development stages and will likely take one or more iterations to develop effective techniques. It is possible that after application of all reasonable best management practices, some TMDLs or their associated targets and surrogates cannot be achieved as originally established. Nevertheless, it is DEQ's expectation that nonpoint sources make a good faith effort to achieving their respective load allocations in the shortest practicable time.

DEQ recognizes that expedited implementation of TMDLs will be socially and economically challenging. Further, there is a desire to minimize economic impacts as much as possible when consistent with protecting water quality and beneficial uses. DEQ further recognizes that, despite the best and most sincere efforts, natural events beyond the control of humans may interfere with or delay attainment of the TMDL and/or its associated targets and surrogates. Such events could be, but are not limited to floods, fire, insect infestations, and drought. Should such events occur that negate all BMP activities, the appropriateness of re-implementing BMPs will be addressed on a case-by-case basis. In any case, post event conditions should not be exacerbated by management activities that would hinder the natural recovery of the system.

For some pollutants, pollutant surrogates have been defined as targets for meeting the TMDLs. The purpose of the surrogates is not to bar or eliminate human access or activity in the basin or its riparian areas. It is the expectation, however, that the specific implementation plan will address how human activities will be managed to achieve the water quality targets and surrogates. It is also recognized that full attainment of pollutant surrogates (system potential vegetation, for example) at all locations may not be feasible due to physical, legal, or other regulatory constraints. To the extent possible, the implementation plan should identify potential constraints, but it should also provide the ability to mitigate those constraints should the opportunity arise. If a nonpoint source that is covered by the TMDL complies with its finalized implementation plan, it will be considered in compliance with the TMDL.

DEQ intends to regularly review progress of the implementation plan. If DEQ determines the implementation plan has been fully implemented, that all feasible management practices have reached maximum expected effectiveness, but a TMDL or its interim targets have not been achieved, DEQ may reopen the TMDL and adjust it or its interim targets.

The implementation of TMDLs and the associated plan is enforceable under the applicable provisions of the water quality standards for point and nonpoint sources by DEQ and other state agencies and local governments in Idaho. However, it is envisioned that sufficient initiative exists on the part of local stakeholders to achieve water quality goals with minimal enforcement. Should the need for additional effort emerge, it is expected that the responsible agency will work with stakeholders to overcome impediments to progress through education, technical support, or enforcement. Enforcement may be necessary in instances of insufficient action towards progress. This could occur first through direct intervention from state or local land management agencies, and secondarily through DEQ. The latter may be based on departmental orders to implement management goals leading to water quality standards.

In employing an adaptive management approach to the TMDL and the implementation plan, DEQ has the following expectations and intentions:

- Subject to available resources, DEQ intends to review the progress of the TMDLs and the implementation plans on a five-year basis.
- DEQ expects that designated agencies will also monitor and document their progress in implementing the provisions of the implementation plans for those pollutant sources for which they are responsible. This information will be provided to DEQ for use in reviewing the TMDL.
- DEQ expects that designated agencies will identify benchmarks for the attainment of TMDL targets and surrogates as part of the specific implementation plans being developed. These benchmarks will be used to measure progress toward the goals outlined in the TMDL.
- DEQ expects designated agencies to revise the components of their implementation plans to address deficiencies where implementation of the specific management techniques are found to be inadequate.
- If DEQ, in consultation with the designated agencies, concludes that all feasible steps have been taken to meet the TMDL and its associated targets and surrogates, and that the TMDL, or the associated targets and surrogates are not practicable, the TMDL may be reopened and revised as appropriate. DEQ would also consider reopening the TMDL should new information become available indicating that the TMDL or its associated targets and/or surrogates should be modified. This decision will be made based on the availability of resources at DEQ.

Monitoring and Evaluation

The objectives of a monitoring effort are to demonstrate long-term recovery, better understand natural variability, track implementation of projects and BMPs, and track effectiveness of TMDL implementation. This monitoring and feedback mechanism is a major component of the "reasonable assurance of implementation" for the TMDL implementation plan.

The implementation plan will be tracked by accounting for the numbers, types, and locations of projects, BMPs, educational activities, or other actions taken to improve or protect water quality. The mechanism for tracking specific implementation efforts will be annual reports to be submitted to DEQ.

The “monitoring and evaluation” component has two basic categories:

- Tracking the implementation progress of specific implementation plans; and
- Tracking the progress of improving water quality through monitoring physical, chemical, and biological parameters.

Monitoring plans will provide information on progress being made toward achieving TMDL allocations and achieving water quality standards, and will help in the interim evaluation of progress as described under the adaptive management approach.

Implementation plan monitoring has two major components:

- Watershed monitoring and
- BMP monitoring.

While DEQ has primary responsibility for watershed monitoring, other agencies and entities have shown an interest in such monitoring. In these instances, data sharing is encouraged. The designated agencies have primary responsibility for BMP monitoring.

Watershed Monitoring

Watershed monitoring measures the success of the implementation measures in accomplishing the overall TMDL goals and includes both in-stream and in-river monitoring. Monitoring of BMPs measures the success of individual pollutant reduction projects. Implementation plan monitoring will also supplement the watershed information available during development of associated TMDLs and fill data gaps.

In the King Hill-C.J. Strike Reservoir TMDL, watershed monitoring has the following objectives:

- Evaluate watershed pollutant sources,
- Refine baseline conditions and pollutant loading,
- Evaluate trends in water quality data,
- Evaluate the collective effectiveness of implementation actions in reducing pollutant loading to the mainstem and/or tributaries, and
- Gather information and fill data gaps to more accurately determine pollutant loading.

BMP/Project Effectiveness Monitoring

Site or BMP-specific monitoring may be included as part of specific treatment projects if determined appropriate and justified, and will be the responsibility of the designated project manager or grant recipient. The objective of an individual project monitoring plan is to verify that BMPs are properly installed, maintained, and working as designed. Monitoring for pollutant reductions at individual projects typically consists of spot checks, annual reviews, and evaluation of advancement toward reduction goals. The results of these reviews can be used to recommend or discourage similar projects in the future and to identify specific watersheds or reaches that are particularly ripe for improvement.

Evaluation of Efforts over Time

Annual reports on progress toward TMDL implementation will be prepared to provide the basis for assessment and evaluation of progress. Documentation of TMDL implementation activities, actual pollutant reduction effectiveness, and projected load reductions for planned actions will be included. If water quality goals are being met, or if trend analyses show that implementation activities are resulting in benefits that indicate that water quality objectives will be met in a reasonable period of time, then implementation of the plan will continue. If monitoring or analyses show that water quality goals are not being met, the TMDL implementation plan will be revised to include modified objectives and a new strategy for implementation activities.

Time Frame

The implementation plan must demonstrate a strategy for implementing and maintaining the plan and the resulting water quality improvements over the long term. The final timeline should be as specific as possible and should include a schedule for BMP installation and/or evaluation, monitoring schedules, reporting dates, and milestones for evaluating progress. There may be disparity in timelines for different subwatersheds. This is acceptable as long as there is reasonable assurance that milestones will be achieved.

The implementation plan will be designed to reduce pollutant loads from sources to meet TMDLs, their associated loads, and water quality standards. DEQ recognizes that where implementation involves significant restoration, water quality standards may not be met for quite some time. In addition, DEQ recognizes that technology for controlling nonpoint source pollution is, in some cases, in the development stages and will likely take one or more iterations to develop effective techniques.

A definitive timeline for implementing the TMDL and the associated allocations will be developed as part of the implementation plan. This timeline will be developed in consultation with the WAG, the designated agencies, and other interested publics. In the meantime, implementation planning will begin immediately (2005). The goal is to attain the water quality standards and return beneficial uses to full support in the shortest time possible. DEQ expects full implementation of the TMDL and recovery of the beneficial uses to take upwards of 20 years. Some subwatersheds may take less time and some may take more, depending on the complexity of the system.